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Transferring Landscape Ecological Knowledge in a Multipartner Landscape: The Border Lakes Region of Minnesota and Ontario

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5.1. INTRODUCTION

The Border Lakes landscape of northeastern Minnesota, United States, and northwestern Ontario, Canada, is dominated by a few major, fire-dependent forest ecosystems, and is owned and managed primarily by government agencies with complex hierarchical structures. The Border Lakes Partnership was created to address direct threats to these ecosystems resulting from the severely altered fire regimes in this 2-million-ha, multiple-owner landscape. Following nearly a century of fire suppression, the fire regime of the Border Lakes landscape has been highly altered from its historical range, and the risk of loss of key ecosystem components is high as a result. The fire regime has departed from its historical frequency (an average return interval of 35 to 100 years) to become a regime with multiple return intervals, and dramatic changes in fire size, intensity, severity, and pattern have also occurred (RMRS 1999). Consequently, the plant species composition and the structure of the forest and other ecosystems have shifted substantially. Without the reintroduction of an ecologically appropriate fire regime or a surrogate management practice that emulates that regime, the jack pine-dominated forest ecosystem, a major part of this landscape, may largely disappear from the Border Lakes landscape in the next 50 to 150 years (Heinselman 1973; Paul Tiné, retired, USDA Forest Service, Superior National Forest, personal communication) and others will continue to be highly altered.

Given the human and ecological contexts of the Border Lakes landscape, strategic collaboration among the stakeholders in this landscape will offer many benefits for land management. In order for stakeholders to collaboratively manage land in a particular landscape, both institutional and technical needs must be met. Institutional support for collaboration throughout the agencies is essential both at a local, implementation level and at higher management levels. Sufficient motivation—political will—to work toward common goals must be present and sustained. From a technical perspective, an understanding of the ecology of the ecosystems that dominate a landscape should form the foundation of any collaborative land management effort. In the Border Lakes landscape, the ecological processes that shape the forest ecosystems are a unifying feature of this landscape, and tools for examining the cumulative outcomes of management activities and natural disturbances on forest ecosystems can help members of the Partnership to establish a joint vision for this landscape and identify opportunities for collaboration among stakeholders. The primary goals of

this chapter are to illustrate how technical knowledge of and tools for understanding the landscape ecology of this forested region were shared with major public landowners, and to highlight the lessons learned in this knowledge transfer process.

Knowledge transferred in this particular effort included ecological principles and models—specifically, forest ecosystem succession models, an interagency ownership map showing various management objectives, and projections of forest attributes under alternative forest management scenarios derived using the LANDIS software (Mladenoff et al. 1996; Mladenoff and He 1999). A subset of the stakeholders—major public landowners, umbrella groups that coordinate among public agencies and other large private entities, and major nonprofit conservation organizations—were the focus of this knowledge transfer effort. Among this subset of stakeholders, the immediate target audience consisted of natural resource professionals and ecologists within each agency or entity; the longer-term audience for the overall effort included both high-level decisionmakers and on-the-ground implementers. Members of both the immediate and the longer-term target audiences have been involved in the knowledge transfer process described in this case study.

The ultimate goal of the Border Lakes Partnership is for the stakeholders to collaboratively achieve their shared desired future condition for the landscape; the initial knowledge transfer described in this chapter is the first small step in this much larger and longer-term effort. The conceptual ecological models, maps, and projections of forest attributes were identified, developed, and shared within the Border Lakes Partnership to provide a scientific foundation on which the major public landowners and other stakeholders can build a common desired future condition. The spatial and temporal scale of the overarching desired outcome is broad—it will be a long-term effort, and the geographic scale is millions of hectares. Although the overall project is strategic, the Partnership also expects to identify specific implementation steps later in the process. Given the scope of this project and the number and type of stakeholders involved, participants in the Border Lakes Partnership have recognized that developing and beginning to implement a common desired future condition in this landscape will take years; achieving the desired future condition will take decades.

5.2. BORDER LAKES BACKGROUND

5.2.1. Description of the Border Lakes Landscape

The Border Lakes landscape is located in northeastern Minnesota and southwestern Ontario (Figure 5.1). Through a larger regional planning process that included The Nature Conservancy, The Nature Conservancy of Canada, the Ontario Ministry of Natural Resources, and their partners, this 2-million-ha landscape was identified as an important area for conservation because it supports several of the forests and other ecosystems that are representative of the larger Superior Mixed Forest ecoregion (SMFEPT 2002).

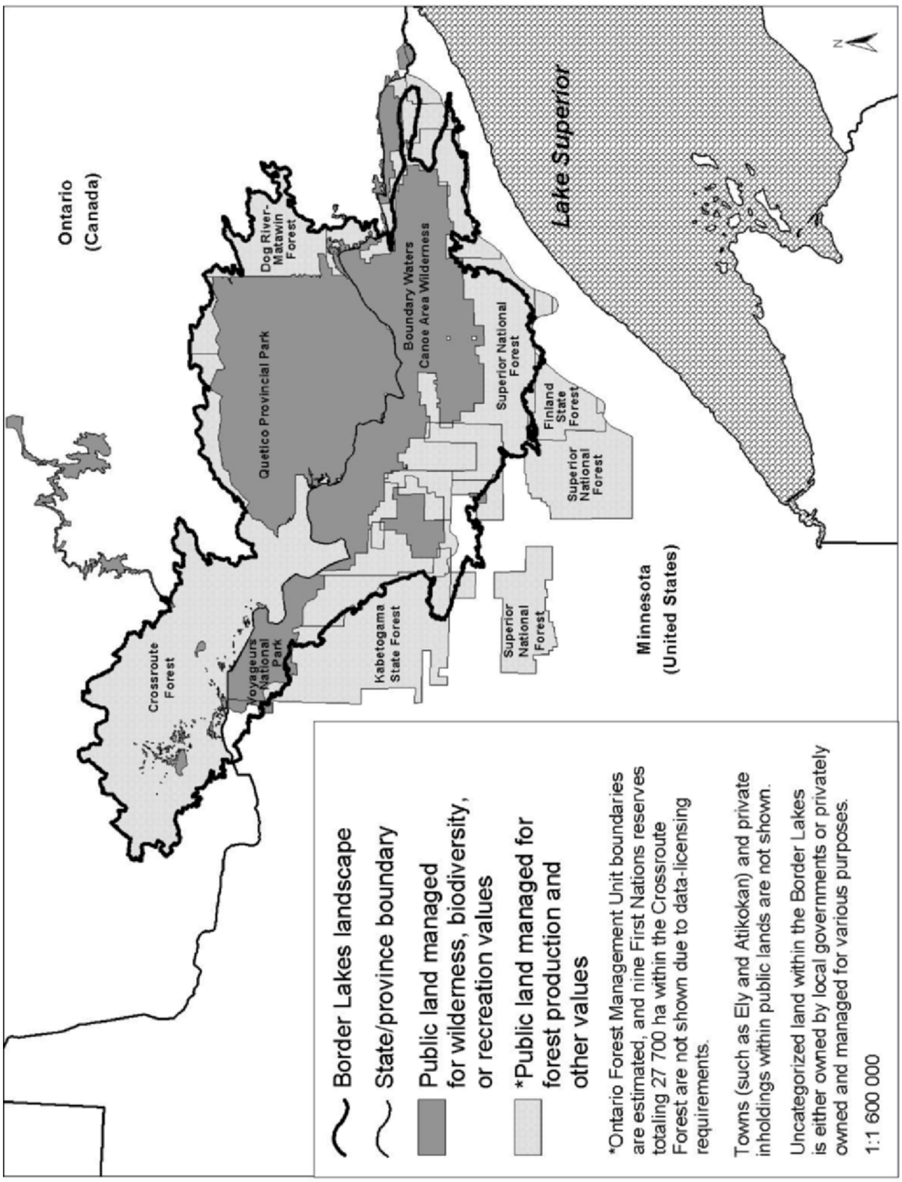

Figure 5.1. Overview of the Border Lakes landscape.

5.2.2. Ecology of the Border Lakes Landscape

The Border Lakes landscape is characterized by near-boreal forest ecosystems interspersed with numerous lakes. The dominant potential natural vegetation across most of this landscape is either jack pine–black spruce forest (*Pinus banksiana* Lamb. and *Picea mariana* [Mill.] B.S.P.) or white pine–red pine forest (*Pinus strobus* L. and *Pinus resinosa* Ait.) (White and Host 2000; W. Bakowsky, Ontario Natural Heritage Information Centre and A. Harris, Northern Bioscience Ecological Consulting, personal communication). The mesic aspen–birch–spruce–fir (*Populus tremuloides* Michx., *Betula papyrifera* Marsh., *Picea glauca* [Moench] Voss, and *Abies balsamea* [L.] Mill.) forest ecosystem is the primary potential vegetation in the eastern portion of this landscape, whereas jack pine–aspen–oak (*Quercus* spp.) forest is predominant in northwestern Minnesota.

Fire, wind, and insect outbreaks are the primary disturbances that shape the successional pathways of the predominant forest ecosystems in the Border Lakes landscape. The size, intensity, and frequency of fires historically varied according to the ecosystem type, as well as in response to climatic conditions, fuel loads, topography, and other factors. For example, the average return interval for stand-killing fires in the jack pine–black spruce forest prior to European settlement was approximately 50 to 100 years and ecologically significant fires were relatively large (400 to 4000 ha or more) (Heinselman 1981). Less intense surface fires in the red pine–white pine forests had an average return interval of around 40 years, and ecologically significant fires ranged from approximately 40 to 400 ha. Today, the average fire return interval for these forest ecosystems is significantly longer—approximately 300 to 2000 years across forest types; the average annual area burned is correspondingly much smaller (Heinselman 1981; Ward et al. 2001).

These changes in the fire regimes are a result of fire exclusion and in some areas, a combination of fire exclusion and land cover changes (Frelich 2002; Heinselman 1981; Ward et al. 2001). In contrast, several major blowdown events occurring within the last 30 years were an order of magnitude larger than those documented during the presettlement era (Frelich 2002). Possible reasons for the apparent increase include an increased proportion of older forests, which are more susceptible to windthrow, and more intense storms resulting from global climate change (Frelich 2002). Prior to European settlement, the natural fire and wind regimes created patterns of age structures and species composition that likely limited the extent, intensity, and duration of insect and disease outbreaks. As a result of modern fire suppression, balsam fir is much more abundant and contiguous, allowing spruce budworm (*Choristoneura fumiferana* Clem.) to spread easily over large areas to create intense outbreaks (Heinselman 1973). Researchers and managers have not yet synthesized sufficient quantitative information on the spread, extent, frequency, and duration of historical insect and disease outbreaks in this region; therefore, changes in the average interval between and geographic extent of insect outbreaks have not yet been quantified.

The interactions among fires, wind damage, and insect outbreaks and their spatial and temporal variation have historically created a mosaic of different vegetation growth stages (after Frelich 2002)—characterized by particular combinations of age structure and species composition—in these matrix-forming forests. (“Matrix” or “matrix-forming” refers to ecosystems that dominate a landscape and thus form the matrix within which other smaller scale ecosystems occur. They occur at scales ranging from hundreds of thousands to millions of hectares.) The relative proportion of the different vegetation growth stages has changed dramatically due to a series of historical and ongoing events. Wholesale clearcutting throughout the region from approximately the 1880s to the 1910s created slash loads that subsequently burned in a series of catastrophic, unnaturally extensive and severe fires. Since then, fire has generally been suppressed, and forests have generally been managed for early successional species. With the advent of fire suppression and the management of forests for economic uses, wind and forestry practices now largely determine the mosaic of vegetation growth stages.

Recent land cover classifications in Minnesota and Ontario (MDNR 2002; Spectranalysis Inc. 1999) and other analyses have indicated that early vegetation growth stages of these forest ecosystems are now predominant: a mixture of aspen–birch forest now covers approximately 27% of the entire landscape. Water bodies account for another 25% of this landscape. Late vegetation growth stages of some forest ecosystems, such as the jack pine-dominated forest ecosystem, are also overrepresented at this time. In the matrix-forming jack pine–black spruce ecosystem, conifers historically dominated the species composition (71.5%). However, forest inventory analysis and cooperative stand analysis data indicate that the current overall species composition has shifted to 56% conifers and 44% hardwoods (Brown and White 2002). Without the introduction of an ecologically appropriate fire regime or a suitable surrogate management regime, the jack pine-dominated ecosystems may largely disappear from this landscape within the next 100 years (Heinselman 1973; Paul Tiné, retired, USDA Forest Service, Superior National Forest, personal communication).

5.2.3. Land Ownership and Management Goals in the Border Lakes Landscape

Based on currently available ownership data (BRW Inc. 1999; OMNR 2003a,b, 2004b), approximately 92% of this landscape is owned by public agencies (Figure 5.2). Ownership in the U.S. portion is relatively more complex because of the numerous levels of government (federal, state, county, and municipal) that own parcels of land, and the relative fragmentation of the parcels across ownerships. Federal, state, county, and municipal lands are intermingled, rather than occurring in consolidated parcels. Major public lands on the Minnesota side of the border include the federally owned Superior National Forest, of which the Boundary Waters Canoe Area Wilderness is a part, Voyageurs National Park, and numerous state forests and parks. The vast majority of land in the Border Lakes region of Ontario is Crown (public) land as well, and is composed primarily of Quetico Provincial Park, and

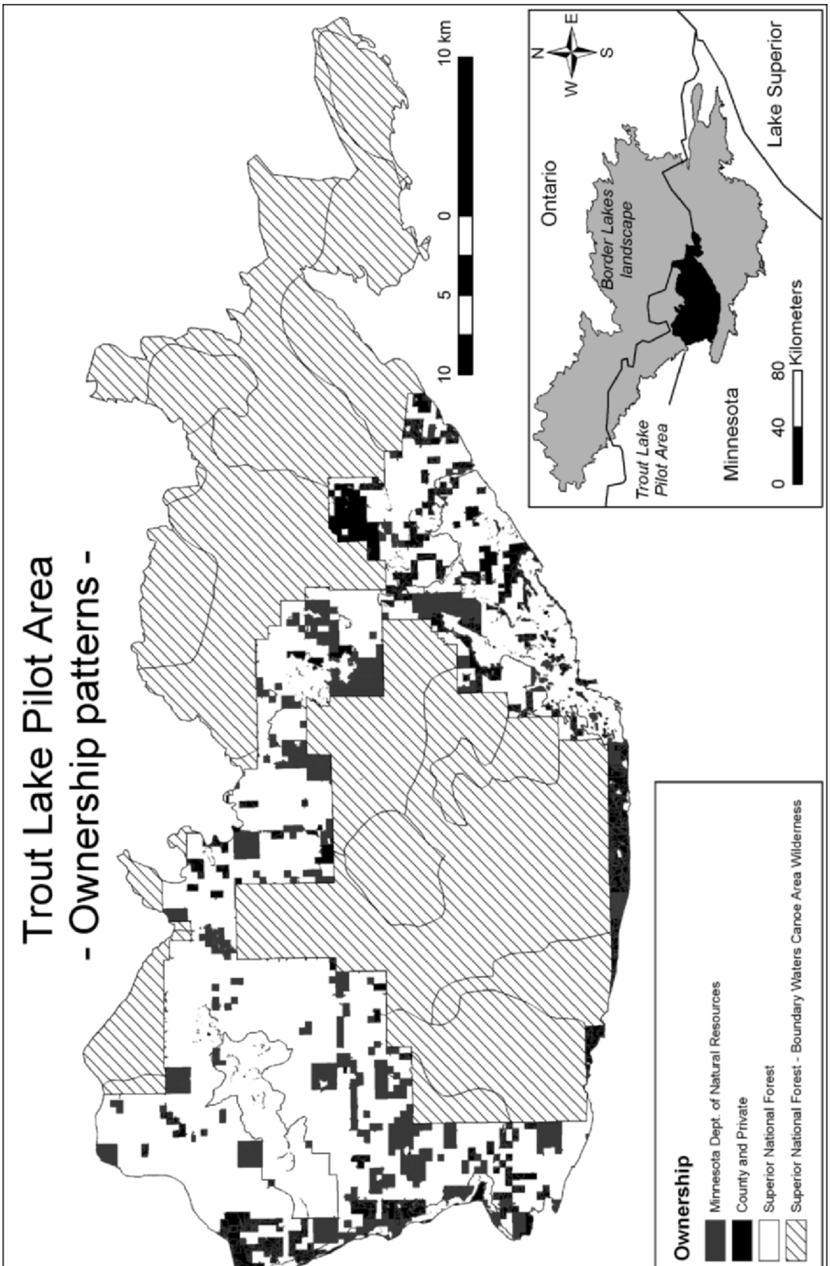

Figure 5.2. Ownership and protected status (data from BRW Inc. 1999; OMNR 2002, 2003a,b, 2004b).

four forest units managed under sustainable forest licenses: the Crossroute, Sapawe, Dog River–Matawin, and Lakehead Forests. Nine First Nations reserves lie within the Crossroute Forest, and First Nations have sovereignty over their land. The pattern of land ownership is relatively simpler in the Ontario portion of the landscape, in part because a single government entity—the province of Ontario—owns roughly 97% of the land and Crown land is broadly divided into fewer, larger units rather than numerous smaller units. As with the First Nations reserves, parcels of privately owned land are embedded within Crown land in this region, but current mapping of the private land is not sufficiently accurate to support precise calculations of its area; however, relative to the amount of Crown land, the total area of private land in the Border Lakes landscape is small. Timber production is a primary management goal on Crown land operated under sustainable forest licenses in Ontario, and in national and state forests in Minnesota. Wilderness areas and parks, such as the Boundary Waters Canoe Area Wilderness and Quetico, are managed primarily for recreation and biodiversity values. Minnesota county and municipal government lands are not highlighted in Figure 5.2, but timber production is a major goal for most of these lands as well. Private lands owned by timber companies are generally also managed for timber production; it is difficult to generalize management goals on other land that is privately owned.

5.3. FUNDAMENTAL RATIONALES FOR WORKING TOWARD A COMMON DESIRED FUTURE CONDITION

The fundamental rationales for the major land-owning agencies, associated coordinating bodies, and nonprofit conservation groups in this region to work together toward a common desired future condition are twofold: (1) their missions significantly overlap or relate to each other, and they generally recognize the importance of all the current uses of this forested landscape, and (2) the driving ecological processes that shape the landscape's forest ecosystems operate at scales that will frequently cross one or more ownership boundaries. Under such circumstances, it is at best inefficient and at worst counterproductive when these stakeholders fail to work together (e.g., Kutas et al. 2002).

5.3.1. Overlapping Stakeholder Missions

Stakeholders in the Border Lakes landscape include numerous public and private entities that own or manage large parcels of land in this region, as well as organized groups with an interest in how the land is managed, individual residents of the Border Lakes region, and the broader community (such as citizens of Minnesota and Ontario) who are interested in the landscape and its various uses. The subset of stakeholders that are the focus of the initial knowledge transfer project described in this chapter are summarized in Table 5.1; this is not an exhaustive list of stakeholders, and focuses only on areas of greatest mission overlap.

5.3.2. Scale of Ecological Processes and Land Ownership Patterns

Fires, windstorms, and insect outbreaks in this landscape vary greatly in size, ranging from hundreds to hundreds of thousands of hectares. The size of contiguous ownership parcels is also variable. Quetico Provincial Park, at nearly 476 000 ha, is the largest single contiguous ownership parcel in this landscape. However, many of Minnesota's state forests and parks, some of Ontario's Sustainable Forest License areas, Voyageurs National Park, and smaller units of the Superior National Forest and the Boundary Waters Canoe Area Wilderness range from roughly 10 000 to 75 000 ha in size. The area affected by a large disturbance event will almost never fit neatly within even the largest contiguous ownership parcels, and will typically cross many smaller ownerships. For example, the 4 July 1999 blowdown affected 237 000 ha of this landscape; 150 000 ha of this affected area were within the Boundary Waters Canoe Area Wilderness, but the remainder were spread across parts of the Superior National Forest, Quetico Provincial Park, and other Crown lands in Ontario (USDA Forest Service 2001). Average- or smaller-sized disturbances will also often cross ownership boundaries in this landscape, as there are numerous smaller and midsize parcels (see Figure 3 in Heinselman 1973 for maps showing fires that extended beyond the Boundary Waters Canoe Area Wilderness).

Managing individual parcels strictly within ownership boundaries is inconsistent with the current understanding of the scale and pattern of the driving ecological processes in this landscape. Instead of viewing the interaction of management practices and disturbance events within the smaller context of a single ownership parcel, it can be helpful to consider those interactions at the scale at which they occur—which means including adjacent ownerships in such considerations. Given the varied scales of disturbance events and of ownership patterns, and the shared goals in shared ecosystems, it makes sense for adjacent landowners to coordinate their management goals, management activities, and responses to and anticipation of major disturbance events.

5.4. PROGRAMMATIC RATIONALES FOR WORKING TOWARD A COMMON DESIRED FUTURE CONDITION

Practical, specific rationales for collaborating include the internal requirements of public agencies to account for the larger context of their management activities, and an improved ability to leverage funds from various government sources that place a high priority on collaborative projects.

5.4.1. Agency Requirements to Address a Larger Management Context

Many of the public agencies that own land in the Border Lakes landscape have broader mandates to address landscape-scale contexts. For example, the U.S. National Environmental Policy Act requires Superior National Forest (and all other national forests) to consider the landscape context in their forest management plans,

Table 5.1. Stakeholder missions related to recreation, biodiversity, timber production, and forest protection (the prevention and suppression of excessive damage to forest resources caused by fire, insects, and diseases). Primary missions are represented by dark gray, secondary missions by light gray

Agency	Mission priority: Recreation	Mission priority: Biodiversity conservation	Mission priority: Timber production	Mission priority: Forest production	Mission statement
Major land managers[a]					
USDA Forest Service: Boundary Waters Canoe Area Wilderness	dark gray	dark gray		dark gray	The Wilderness Act established the National Wilderness Preservation System in order to "...secure for the American people of present and future generations the benefits of an enduring resource of wilderness".
USDA Forest Service: Superior National Forest	dark gray	light gray	dark gray	light gray	"The mission of the USDA Forest Service is to sustain the health, diversity, and productivity of the Nation's forests and grasslands to meet the needs of present and future generations."
U.S. National Park Service: Voyageurs National Park	dark gray	light gray		light gray	"The National Park Service preserves unimpaired the natural and cultural resources and values of the national park system for the enjoyment, education, and inspiration of this and future generations. The Park Service cooperates with partners to extend the benefits of natural and cultural resource conservation and outdoor recreation throughout this country and the world."
Minnesota Department of Natural Resources	dark gray	dark gray	dark gray	dark gray	"Our mission is to work with citizens to conserve and manage the state's natural resources, to provide outdoor recreation opportunities, and to provide for commercial uses of natural resources in a way that creates a sustainable quality of life."
Minnesota Department of Natural Resources: Division of Forestry (state forests)	light gray		dark gray	light gray	"Through shared information, technology, and understanding, we empower others and ourselves to sustain and enhance functioning forest ecosystems; provide a sustainable supply of forest resources to meet human needs (e.g., material, economic, and social); protect lives and property from wildfires; and provide a dollar return to the permanent school trust."
Minnesota Department of Natural Resources: Parks and Recreation (state parks)	dark gray	dark gray		light gray	Parks and Recreation "will work with people to provide a state park system which preserves and manages Minnesota's natural, scenic, and cultural resources for present and future generations while providing appropriate recreational and educational opportunities."

Ontario Ministry of Natural Resources: Parks and Recreation Quetico Provincial Park	"To ensure that Ontario's provincial parks protect significant natural, cultural, and recreational environments, while providing ample opportunities for visitors to participate in recreational activities." As a wilderness park, Quetico's specific mission is to "preserve Quetico Provincial Park, which contains an environment of geological, biological, cultural and recreational significance, in perpetuity for the people of Ontario as an area of wilderness that is not adversely affected by human activities."
Ontario Ministry of Natural Resources: Forestry	"To ensure excellence in the management and protection of Ontario's forests and the provision of specialty resource management services." Vision: "Sustainable Forests—healthy forests providing balanced environmental, social and economic benefits now and forever."
Other stakeholders	
The Nature Conservancy	"To preserve the plants, animals and natural communities that represent the diversity of life on Earth by protecting the lands and waters they need to survive."
The Nature Conservancy of Canada	"NCC protects plants, animals and natural communities by safeguarding the land and waters they need to survive."
Minnesota Forest Resources Council	Vision: "Minnesota forests are managed with primary consideration given to long-term ecosystem integrity and sustaining healthy economies and human communities. Forest resource policy and management decisions are based on credible science, community values, and broad-based citizen involvement. The public understands and appreciates Minnesota's forest resources and is involved in and supports decisions regarding their use, management and protection."
Minnesota Incident Command System, Prescribed Fire Working Team/Minnesota Interagency Fire Center	The team and center comprise U.S. federal and state agencies, including the Minnesota Department of Natural Resources, USDA Forest Service, National Park Service, U.S. Fish and Wildlife Service, and Minnesota Department of Public Safety, and provide coordination, education, and implementation of the Incident Command System to support responses to fires and all risk incidents in Minnesota and nationally.

[a] An agency or other entity that owns and manages more than 20,000 ha in the Border Lakes landscape.

timber sales, wildlife improvement plans, and other activities. The same will be true for Voyageurs National Park (and all national parks) when they update their management plans. In addition, the public agencies and private industry in Minnesota have made commitments to assess the landscape-level impacts of their forest management practices. The Minnesota Department of Natural Resources, for example, has recently decided to attain certification under both the Forest Stewardship Council and the Sustainable Forest Initiative for its forests and forestry operations; certification by either program explicitly requires a consideration of the landscape context in their forest management decisions. The Ontario Ministry of Natural Resources' Crown forest planning guidelines (OMNR 2004a) require that "management objectives in each forest management plan be compatible with the sustainability of the Crown forest," and the Crown forests surrounding Quetico Provincial Park are required to consider the impacts of their management on Quetico.

Agency requirements for considering the landscape context in their management activities appear to be part of a longer-term trend within many government agencies to strive for greater efficiency and effectiveness through collaboration. In the United States, the 2001 Federal Wildland Fire Policy, which will be implemented through the National Fire Plan, recognizes that "Federal, State, tribal, local, interagency, and international coordination and cooperation are essential" and subsequently requires that "Fire management planning, preparedness, prevention, suppression, fire use, restoration and rehabilitation, monitoring, research, and education will be conducted on an interagency basis with the involvement of cooperators and partners." In the Border Lakes region, additional collaborative efforts are underway to address slightly different sets of issues at the landscape scale. In Ontario, a formal network of researchers, agencies, and organizations is conducting a variety of research projects relating to sustainable forest management within the "Legacy Forest," which includes the southern half of the Dog River–Matawin Forest and the adjacent Quetico Park; one of the major long-term goals of the network is to understand the landscape-level impacts of various forest management practices (http://www.legacyforest.ca/). Minnesota's Forest Resources Council continues to coordinate regional forest management planning across the state. In addition, effective coordination of fire management is taking place among state, provincial, and national public agencies in northern Minnesota and northwestern Ontario, partly as a result of the 1999 blowdown, which greatly increased the future risk of large fires. Most of the partners involved in the present Border Lakes effort have been involved in the aforementioned efforts, and some are also part of Ontario's Legacy Forest project; these previously established initiatives have created a solid precedent for collaborating on issues that transcend ownership boundaries.

5.4.2. Improved Ability to Leverage Government Funds

Many government grants set a high priority or even a requirement for funding proposals to include appropriate, effective partnerships and collaborations rather than directing funds to individual entities working independently. The United States

National Fire Plan funding guidelines (www.fireplan.gov) specify that an important criterion for a project to successfully compete for funding is having large-scale, broad partnerships with clear local community support. It is not uncommon for successful National Fire Plan proposals to list six or more "secondary partners" in addition to the recipient of the funding award. In 2003, US$426 million of funding from the Healthy Forest Restoration Act (P.L. 108-148; http://www.healthyforests.gov/initiative/legislation.html) was used to implement projects for the reduction of hazardous fuels across the nation. This Act emphasizes improved coordination among agencies, such that federal fire activities, including rehabilitation and restoration of land, are integrated with those of states, First Nations, and local governments (www.fireplan.gov/healthyforest/index.html). Canada's Sustainable Forest Management Network funds projects that focus on questions such as how to develop tools for scenario planning and assessment under different combinations of multiple-use forest values and land-use intensities. It emphasizes innovative proposals involving interdisciplinary research teams that assess forest management strategies and alternatives using science-based criteria (http://sfm-1.biology.ualberta.ca/english/research/en_cfp.htm). Given this trend, stakeholders who can demonstrate truly cooperative projects in a landscape context have a better chance to obtain funding from a wider variety of sources.

5.5. CHALLENGES IN WORKING TOWARD A COMMON DESIRED FUTURE CONDITION

Many of the specific challenges to achieving a common desired future condition in the Border Lakes landscape stem from two inherent political characteristics of this landscape: there are multiple political jurisdictions (Canada and the United States, Ontario and Minnesota), which include an international border, and numerous public and private landowners, which include multiple levels of government agencies (national, state and provincial, and local). In general, the more stakeholders and landowners involved, the more difficult it is to plan and implement landscape-scale conservation and management activities (see Kutas et al. 2002 and Pedynowski 2003).

In the Border Lakes landscape, many of the stakeholders are large government agencies, and although their missions overlap significantly, each stakeholder must nonetheless accomplish its particular mission and answer to its local, state or provincial, or national constituency. In addition, it is often challenging for large organizations to respond quickly to new ideas, tools, or approaches. With so many geographically scattered stakeholders in a large landscape, the logistical difficulties and the costs of coordination and of face-to-face collaboration are greatly magnified. Bureaucratic constraints on staff travel across state, provincial, or international borders can further impede active collaboration.

Although public agencies that own and manage land have internal mandates to consider in their management in the context of the larger landscape, to date they have generally lacked the tools and the human and financial resources to do so in a

coordinated, strategic way. As mentioned earlier in this chapter, many of the agencies that own land in the Border Lakes landscape have already conducted independent planning efforts to address their institutional missions. Although some of the plans addressed the landscape context of their proposed actions by assessing the actions of nearby landowners, these assessments were limited because they only evaluated the general trends in forest management by neighboring land management agencies; detailed assessments of the spatial and temporal patterns of management activities typically are not conducted. In addition, agency staff are often so consumed with their agency's planning efforts, in addition to their regular duties, that they have very few opportunities to address cross-boundary, landscape-level issues. There is thus an incomplete picture of how management plans add up to a cumulative, landscape-level whole.

The number of and variation in stakeholders also means that the consistent data sets necessary to build the scientific foundations for this kind of collaboration may be lacking, or that it may require substantial effort to develop baseline consistency among existing data sets. In some cases, attempting to create such consistency among data sets will oversimplify them to the point where they are no longer useful for analysis. Truly consistent data sets may not exist, especially when working across major political boundaries (international, state, or provincial). The quality of the data often varies across jurisdictions—even if the data are consistent, their quality (e.g., accuracy, level of detail) may be insufficient. When high-quality data do exist, they may not be readily available because of their format, proprietary nature, or differences in data-sharing customs.

The third challenge is somewhat independent of jurisdictions and ownership. Determining the most effective management strategies for moving a landscape from the current to the desired condition requires a degree of tolerance of scientific uncertainty and modeling skills that many practitioners lack. Nonetheless, the scientific uncertainty associated with modeling principles and tools presented much less of a barrier than the larger issue posed by the number of jurisdictions and stakeholders.

Finally, it is important to recognize that beyond the challenges identified above, fundamental challenges are also posed by the overall political and social context of the landscape. Moving this landscape to a mutually agreeable desired future condition will ultimately require the support of not only the major landowners, but also of local communities, smaller landowners, and other interested parties.

5.6. THE KNOWLEDGE TRANSFER PROCESS

A cooperative project between The Nature Conservancy, the USDA Forest Service, and the Department of the Interior led to the creation of the Fire Learning Network in 2002 in an effort to overcome implementation barriers to ecologically appropriate projects that reduce hazardous fuels and restore fire-dependent ecosystems (http://tncfire.org/training_fire.htm). A series of collaborative forums organized by the Network provided a framework and approach for knowledge transfer in the Border Lakes Partnership. The importance of a collaborative learning approach to

knowledge transfer is illustrated later in this section by descriptions of each phase of the project. Detailed descriptions include the challenges encountered with each step and how those challenges were addressed. Key steps are summarized in Table 5.2. Although considerable progress has been made during the last 2 years, the first four phases represent a collaborative learning process that we hope will provide the foundation for a project that spans multiple years. The overarching goal is to engage partners in developing a long-term, large-scale vision that they will implement through the identification of strategic, collaborative opportunities.

5.6.1. Phase One: Initiate the Collaborative Learning Process

We initiated the collaborative learning process in the winter of 2003 with a knowledge transfer forum held under the auspices of the Fire Learning Network. Participants included representatives from the USDA Forest Service (Superior National Forest and North Central Research Station), the National Park Service (Voyageurs National Park), Ontario Ministry of Natural Resources (Quetico Provincial Park), the Minnesota Department of Natural Resources, and The Nature

Table 5.2. Timing of the key steps in the knowledge transfer process for the first two years of the Border Lakes Partnership

Knowledge transfer process	Time frame	Steps
Phase one: initiate the collaborative learning process	Winter 2003	Hold the first knowledge transfer forum, with an emphasis on ecological models and qualitative desired future condition.
Phase two: develop a pilot model	Spring and summer 2003	Assemble data layers from partner agencies and gather partner input on assumptions for the pilot modeling exercise.
	Fall 2003	Hold a second knowledge transfer forum, with an emphasis on developing a spatially explicit desired future condition.
Phase three: early review of the pilot model	Winter 2004	Present the results of the pilot modeling exercise to each of the four key agency partners for input and refinement.
Phase four: build institutional support	Spring 2004	Begin building institutional support for expanding the collaborative modeling exercise to the whole landscape, including meetings with agency technical leadership and the development of communication products such as a fact sheet.
	Summer 2004	Hold a third knowledge transfer forum, with an emphasis on refining a spatially explicit desired future condition and developing strategies for overcoming challenges to future implementation.
Next steps: increase the scale and impact of the initiative	Winter and spring 2005	Assemble data layers for expanding the modeling to encompass the full 2-million-ha landscape.
	Winter and spring 2005	Hold a meeting of technical team partners to discuss future uses of scenario modeling, including the selection of a desired future condition.
	Fall and winter 2005	Hold a fourth knowledge transfer forum, with an emphasis on selecting a collaborative desired future condition and examining options for collaborative, cross-boundary projects.

Conservancy. Prior to the forum, we sought participant input on the forum's goals, the conceptual ecological models to be considered, and a qualitative description of the desired future condition. We also engaged the Minnesota Incident Command System, the lead interagency fire organization in the state. The early approval of the System's Prescribed Fire Working Team was crucial, and they assisted with publicizing the forum. As a result, agency attendance was excellent, even though there was some confusion about the purpose of the forum. Several conceptual ecological models formed the basis for the Border Lakes discussion with the goal of establishing a common language about ecological processes and successional pathways (e.g., Figure 5.3; Brown and White 2002). Although opinions varied on the broad application of the models, the models nonetheless provided an important conceptual starting point for developing a common understanding of natural disturbance regimes in the Border Lakes landscape.

How to develop a long-term (100 years), quantitative set of spatially explicit description of the desired future conditions for the landscape was a more difficult topic for the group to tackle. Although in principle all partners acknowledged the advantages of working collaboratively, they focused initially on programmatic benefits such as securing federal monies for cross-boundary projects. Before committing to collaboration on a common vision, partners requested that The Nature Conservancy facilitate the modeling of several alternative forest management scenarios across the Border Lakes landscape to inform their development of a desired future condition. They further recommended that we start by modeling forest management scenarios for a smaller, pilot project area to test the applicability of this modeling approach for the entire landscape. To move the modeling process forward, a small team of the partners volunteered to identify a suitable landscape for the pilot project, conduct the pilot assessment, and report back to the full Border Lakes Partnership on their progress and the initial results.

The high degree to which partners were engaged in the discussion emerged as the primary achievement during Phase One of the project. However, the discussion tended to leap ahead into strategy development rather than laying the groundwork for establishing a joint vision. Our experience is that this is a common tendency among land managers, particularly for a large landscape with complex ownership patterns. Rather than forcing the visioning process, we documented strategy suggestions throughout Phase One to assist in later phases of the collaboration.

5.6.2. Phase Two: Pilot Modeling Project

Subsequent to the decision to proceed with a modeling approach, the modeling team identified a number of "sideboards." First, they agreed that the pilot landscape should contain a sufficient range of initial conditions (e.g., forest structures, stand compositions, and stand ages) and management objectives to ensure that the model's projections would provide insights into the entire Border Lakes landscape. Second, they agreed that the modeling exercise should project the future of several management scenarios that reflected different sets of assumptions about the management activities undertaken within the pilot project area. The resulting landscape projections could

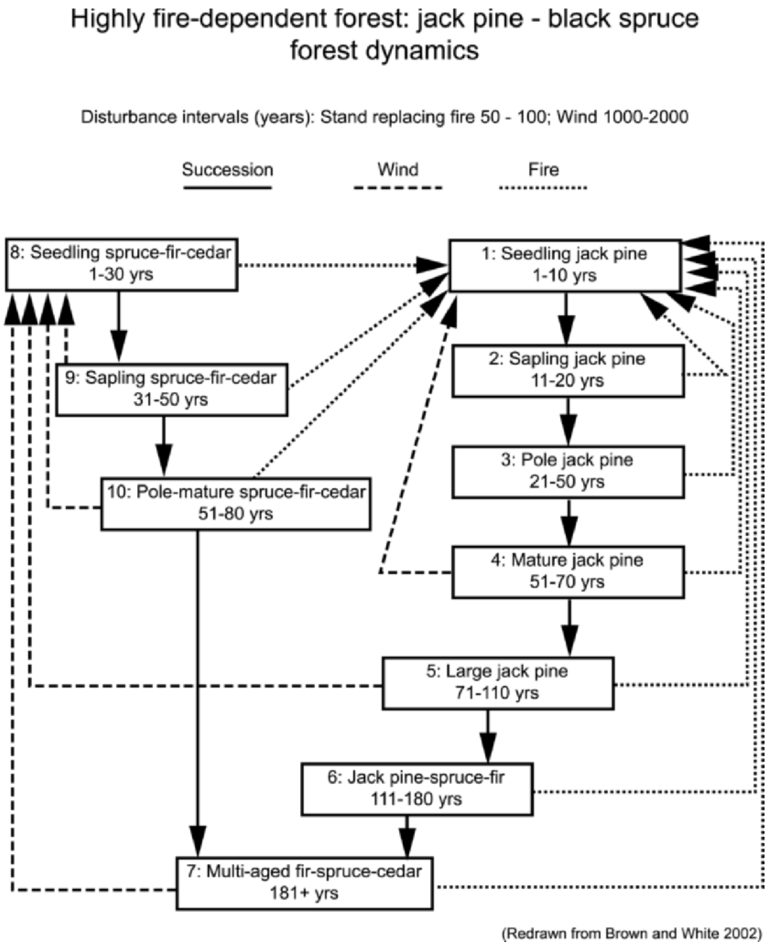

Figure 5.3. Example of the conceptual state and transition model used for the knowledge transfer exercise, with natural resource managers as the intended audience. Each box describes a unique vegetation growth stage (numbered 1 through 10), with the stand age determined by time since last disturbance. Arrows show changes in forest age, composition, and structure resulting from succession and canopy-replacing wind and fire disturbances.

thus provide a range of outcomes for the Border Lakes partners to use in the development of the desired future condition for the landscape. These management scenarios were to be based on the planning work of the partner management agencies, although the modeling team also felt strongly that the management scenarios should not be constrained by these forest management plans if there was reason to model the use of alternative management tools and techniques.

The modeling team selected the Trout Lake land type association in Minnesota (hereafter referred to as the Trout Lake pilot area; Figure 5.4) as its pilot landscape. In this context, a land type association is a fine-scale ecological map unit within the ecological land classification system (Bailey 1995) developed by the USDA Forest

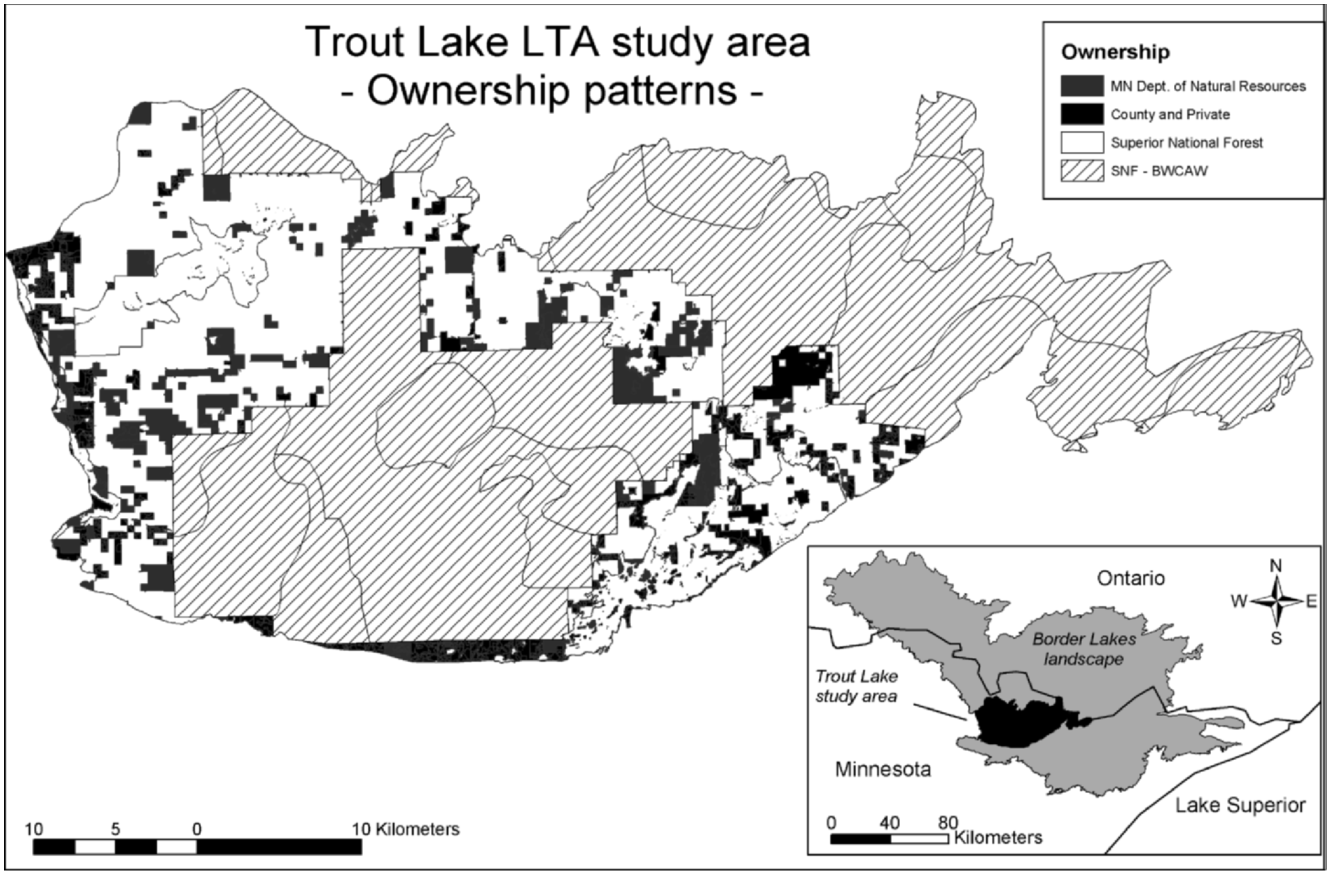

Figure 5.4. Land ownership within the Trout Lake pilot area. The Superior National Forest and Minnesota Department of Natural Resources have the largest holdings. The “Other” category includes county and private nonindustrial ownerships.

Service. This 160 000-ha area is centrally located within the Border Lakes landscape, and is similar to the larger landscape in that most of the area is publicly owned and is managed for multiple objectives ranging from wilderness to intensive timber production. The ownership pattern is fragmented, with a mixture of lands managed by the Minnesota Department of Natural Resources and the Superior National Forest dominating the landscape. The selection of a single element within the ecological classification system also worked well as a basis for the simulation model because it simplified the development of site-specific model parameters.

The team used the LANDIS forest dynamics simulation software (Mladenoff et al. 1996; Mladenoff and He 1999) to carry out the landscape simulations requested by the Border Lakes partners. This tool simulates succession, fire, harvesting, and wind damage over large areas (10^4 to 10^6 ha) and long time spans (10 to 1000 years), and is thus well suited for the type of analysis the Border Lakes partners desired. An overview of the model is presented in Table 5.3. The model allowed partners to

Table 5.3. An overview of the attributes and data requirements of the LANDIS software

Parameter	Specifics
Purpose	A spatially explicit simulation model of landscape-level forest dynamics
Spatial domain	10 000 to >1 000 000 ha
Temporal domain	100 to >1000 years, in 10-year time steps
Processes simulated	Seed dispersal
	Competition
	Fire
	Wind
	Harvesting
	Biological disturbances such as disease and insects
	Fuel accumulation and decay
	Biomass accumulation and decay
Required data	Maps of forest composition and age
	A map of land types
	For fire: return intervals and mean, minimum, and maximum fire sizes
	For wind: return intervals and mean, minimum, and maximum areas of storm damage
	For harvesting: minimum harvestable area, species preferences, adjacency rules, reentry periods, and many other relevant parameters
	Species characteristics
Model output	Species composition and age
	Forest stand maps
	Fire maps
	Wind maps
	Harvesting maps
	Disease and insect outbreak maps
	Fuel maps
	Biomass maps
Model structure	Raster-based, with variable cell size (10 to 100 m)
	Within each cell, species cohorts are tracked by age
Developers	David Mladenoff (University of Wisconsin–Madison)
	Hong He (University of Missouri–Columbia)

develop spatially and temporally explicit examinations of the goals of the partner agencies, and of the important interacting processes (timber harvesting, forest succession, and fire) that affect the Border Lakes landscape. Reinforcing the need for a spatial analysis was the recognition that some land management objectives are incompatible when arranged in certain spatial patterns (e.g., two adjacent parcels, one managed for a wilderness objective and the other for intensive timber production), and that a nonspatial assessment could not identify such incompatibilities. However, use of the LANDIS model created new challenges for knowledge transfer. Parameterization and implementation of the modeling scenarios in LANDIS requires expert modeling skills that take months for even a highly trained individual to learn. As such, it was not realistic to expect the Border Lakes partners to take this tool and run their own scenarios. Thus, we were challenged to simplify this complexity sufficiently that partners could remain active participants in the use of this modeling tool and that key stages of the modeling were as transparent as possible. At this stage, a core group of two staff from The Nature Conservancy and the USDA Forest Service's North Central Research Station took responsibility for moving the project forward. The Nature Conservancy focused on cultivating relationships with the primary partners, while the North Central Research Station took the technical lead in data acquisition and modeling.

The management scenarios selected by the modeling team included components of each of three core elements: the management strategy, the role of prescribed fire, and the role of wildfire. The management strategy contrasted the current management plans of the partner agencies with newly proposed (but not yet implemented) management plans. In 2004, the Superior National Forest finalized and implemented its revised forest plan (USDA Forest Service 2004). The model scenarios described here are, however, based on the Draft Forest Plan Revision (i.e., the best information available at the time of the modeling exercise; USDA Forest Service 2004). For clarity, the Draft Forest Plan Revision is referred to henceforth as the "proposed plan," and the now-outdated Superior National Forest Plan of 1986 (USDA Forest Service 1986) is referred to as the "current plan." Within the Trout Lake pilot area, the current and proposed plans differed substantially in their objectives (Figure 5.5a,b).

The second and third elements contrasted the effects of the current policy of fire suppression with alternative strategies in which prescribed fire and managed wildfire were used to achieve management goals. These elements reflected the modeling team's concerns about the 80-year history of fire suppression within the Border Lakes landscape. Of the eight possible combinations of options, three management scenarios were selected for analysis: the current management strategy combined with fire suppression (i.e., the status quo), the proposed management strategy combined with fire suppression (i.e., the strategy likely to be implemented on the ground in the near future), and the proposed management strategy combined with the use of both prescribed fire and managed wildfire. In addition to these three management scenarios, a fourth scenario paired a strategy of no timber harvesting with fire suppression. This scenario served as a control and was added to assess the impact of a

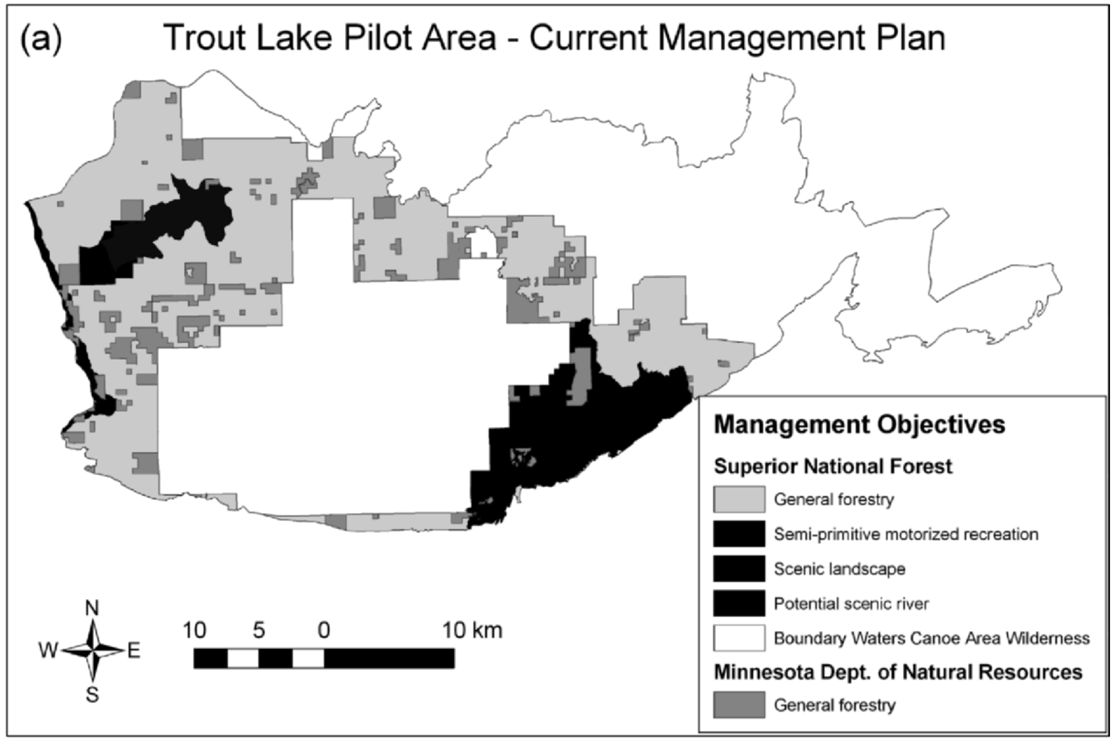

Figure 5.5. (a) Current management objectives within the Trout Lake pilot area. The “General forestry” objective is achieved through the use of a variety of silvicultural techniques, but relies most heavily on even-aged management practices, including clearcut harvesting. The “Scenic landscape,” “Potential scenic river,” and “Semi-primitive motorized recreation” objectives balance timber production with recreational goals, and make greater use of partial harvesting and uneven-aged management practices. No timber harvesting is allowed within the Boundary Waters Canoe Area Wilderness. Fire suppression is permitted to support all management objectives.

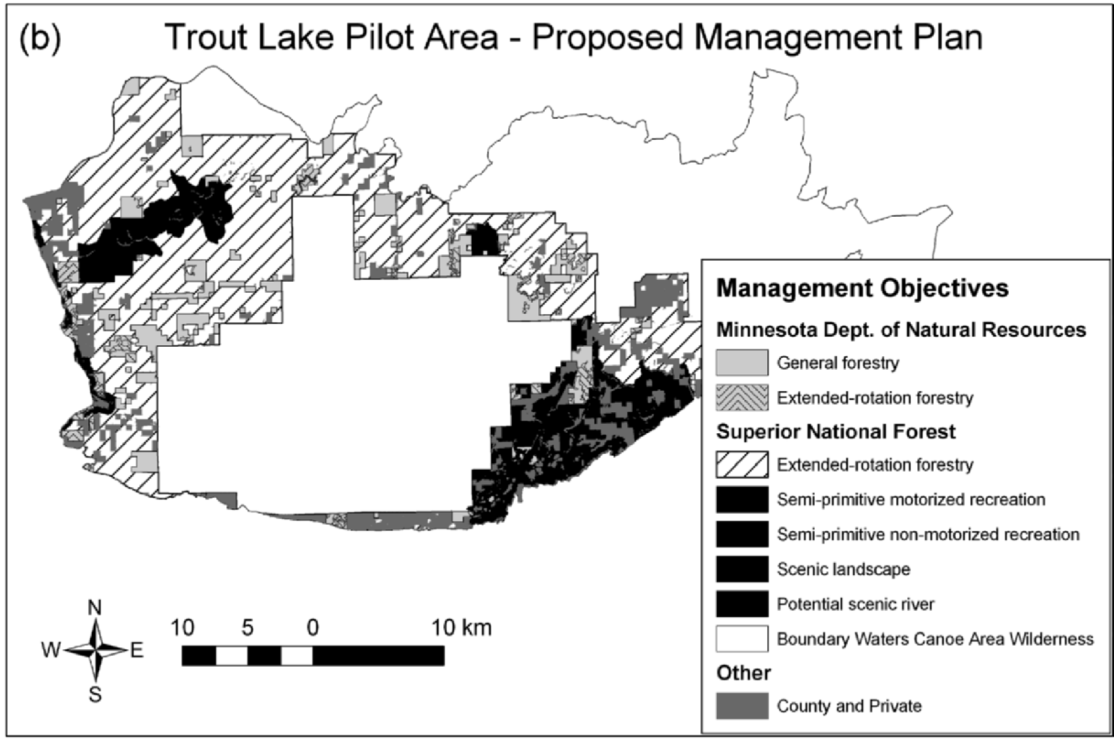

Figure 5.5. Cont'd (b) Management objectives proposed within the Superior National Forest's draft forest management plan, and the Minnesota Department of Natural Resources draft Border Lakes subsection forest management plan. The "Extended-rotation forestry" objective utilized longer timber harvest rotations than the "General forestry" objective, and also relied less heavily on even-aged management. The "Semi-primitive motorized recreation," Semi-primitive non-motorized recreation," "Scenic landscape," and "Potential scenic river" objectives balance timber production with recreational goals, and make greater use of partial harvesting and uneven-aged management practices. The "General forestry" objectives are the same as described in (a).

“hands-off” management approach, which provided a useful reference point for discussions between the management partners and external stakeholders concerned with the effects of forest management.

The initial data for the LANDIS modeling project (including forest composition, structure, and age; maps of management objectives; and descriptions of the techniques used to meet the objectives) were provided to the modeling team by the Border Lakes partners. These data are collected and maintained in a digital format by the largest public and private forest management organizations, and thus required relatively little manipulation before they could be fed into the model. Data on harvesting rates and techniques are somewhat more difficult to convert into model-accessible formats, but even this process was relatively easy because the members of the modeling team drew on the expertise within their own agencies to provide the necessary data. The parameterization phase of the modeling effort also proved helpful to the modeling team for a completely different reason: it allowed those unfamiliar with LANDIS to learn more about its structure, assumptions, and outputs. In turn, this knowledge helped the team define the types of data to be produced by the project, and the types of conclusions these data would support.

Once the parameterization was complete and the team had determined the types of outputs the model would be used to generate, the simulations were conducted and the raw data were compiled and presented to the modeling team for evaluation. Although the original purpose of the evaluation was to refine the outputs that would be presented at a meeting of the Border Lakes partners, it also served a second, and unintended, purpose: it allowed the modeling team members to compare the model projections with their own expectations. The model projections were uniformly seen as reasonable and logical outcomes of the four management scenarios, and thus were essentially “validated” by the modeling team. As a result, the team members were willing to promote the Border Lakes Partnership process within their own organizations, to arrange access to key decisionmakers, and to provide funding to continue the project. In retrospect, the opportunity to validate model projections was a critical step in the progress of the Border Lakes Partnership.

Model projections provided insights into the potential effects of forest management within the Trout Lake pilot area, and highlighted the importance of a landscapewide assessment in measuring these effects. Among the most interesting results from the Trout Lake modeling process are those that place the ability to achieve the goals of the management agencies (as outlined within the agency planning documents) into a broader landscape context. For example, one of the goals contained within the management scenario based on the proposed management plans was an increase in the area occupied by red pine and white pine. This goal was shared by both the Superior National Forest and the Minnesota Department of Natural Resources, and their planning documents show that where they actively manage the landscape (i.e., the areas outside the Boundary Waters Canoe Area Wilderness) through timber harvesting and other tools, this goal is being met (MDNR 2004; USDA Forest Service 2004). However, when the unmanaged portions of the Trout Lake pilot area were also included in the analysis, there was no evidence of an increase in red pine and white

pine stands at the landscape scale, and little difference between the current and proposed management plans (Figure 5.6a). At the landscape scale, therefore, the maintenance of existing red pine and white pine stands and the creation of new ones through active management was balanced by the loss of stands due to natural successional processes in unmanaged portions of the landscape. The goal defined for the actively managed portions of the landscape was thus not achieved when considered in the larger landscape context. However, using prescribed burns and wildfire as a management tool could increase the abundance of both pines across the landscape, both when stands of these species are considered and when the abundance of both species across all stand types is considered (Figure 5.6a,b).

Figure 5.7 provides a second example of the importance of the landscape context in developing the desired future condition by depicting a small portion of the pilot area under the proposed management plans of the Minnesota Department of Natural Resources and the Superior National Forest. As the figure demonstrates, management objectives can vary greatly across even a small area, and potentially conflicting management objectives may exist in close proximity. The juxtaposition of wilderness, general timber production, extended-rotation forestry, and recreational objectives within a small area may create challenges for land managers attempting to achieve goals related to wildlife, aesthetics, and recreation, not because of their own management actions, but because of management actions taken in adjacent land ownerships.

The examples of red pine and white pine stands and of conflicting management objectives in adjacent ownership parcels are not intended as a criticism of the planning processes of the Border Lakes project partners. Indeed, within the context of their planning activities, the agencies with ownership in the Trout Lake pilot area were successful in meeting their goals. Rather, these examples are intended to highlight two points: (1) understanding the context within which plans are developed and implemented is critical, as the ability to meet goals changes when the spatial or temporal scale of the analysis changes, and (2) a landscape-level analysis can add value to the planning processes of individual stakeholders by changing the scale, and thus the perspective, of the analysis. The experience of the Trout Lake modeling group suggests that these points were lost neither on the Border Lakes partners nor on key decisionmakers within the partner agencies. For example, when Figure 5.7 was shown to partners and decisionmakers, there was a ready acknowledgment of potential management incompatibilities and, more significantly, a willingness to consider strategies that would increase coordination of management actions across ownership boundaries and possibly to spatially rearrange the management objectives in order to reduce management conflicts.

5.6.3. Phase Three: Early Review of the Pilot Model

Flexibility in meeting with partners individually and in small groups was especially important during the review of the pilot model, in addition to during the formal forums held by the Fire Learning Network. During Phase Three, two distinct audiences for

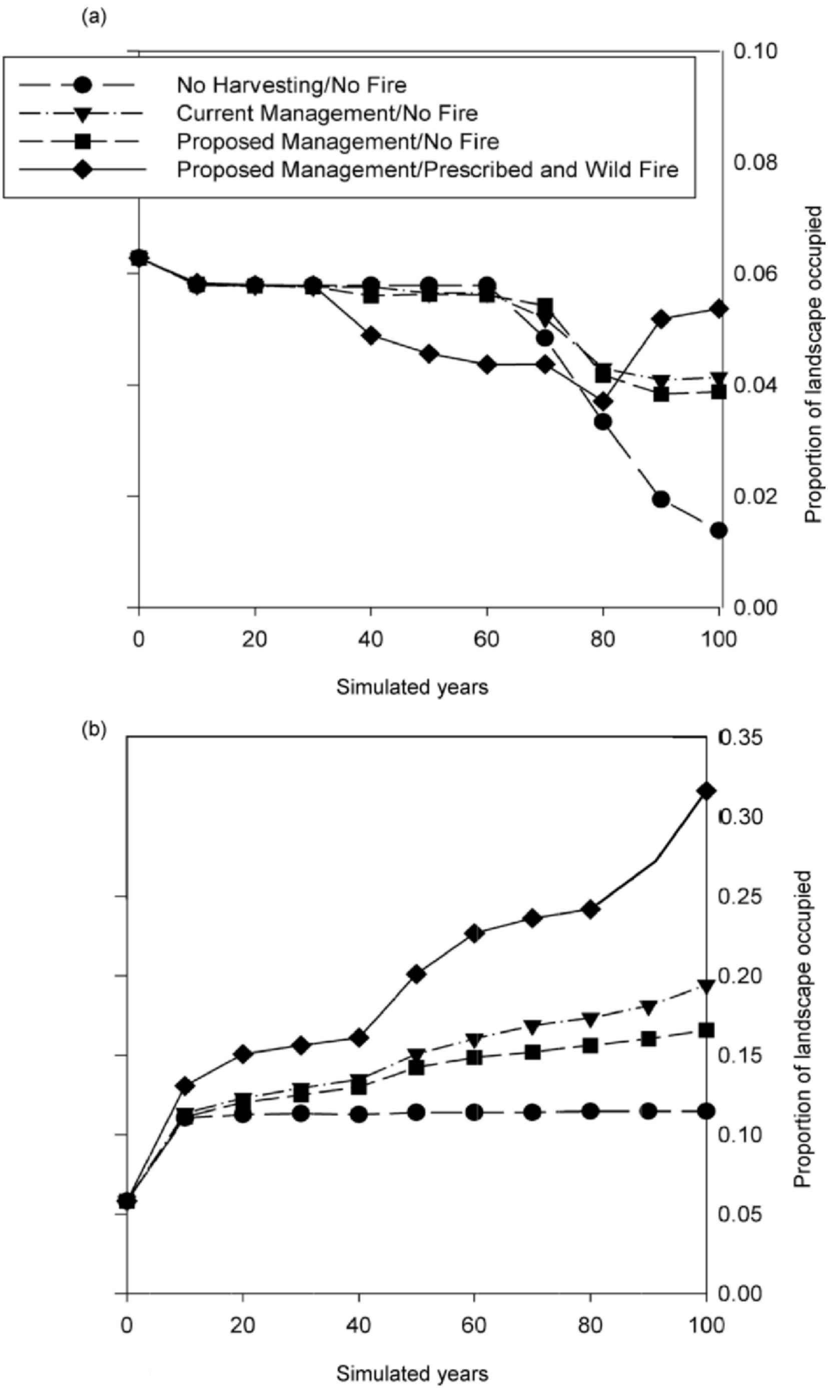

Figure 5.6. The projected abundance of red pine and white pine across the Trout Lake pilot area, as a proportion of the landscape, under four management scenarios: (a) red and white pine stands and (b) red and white pine as component of all stand types.

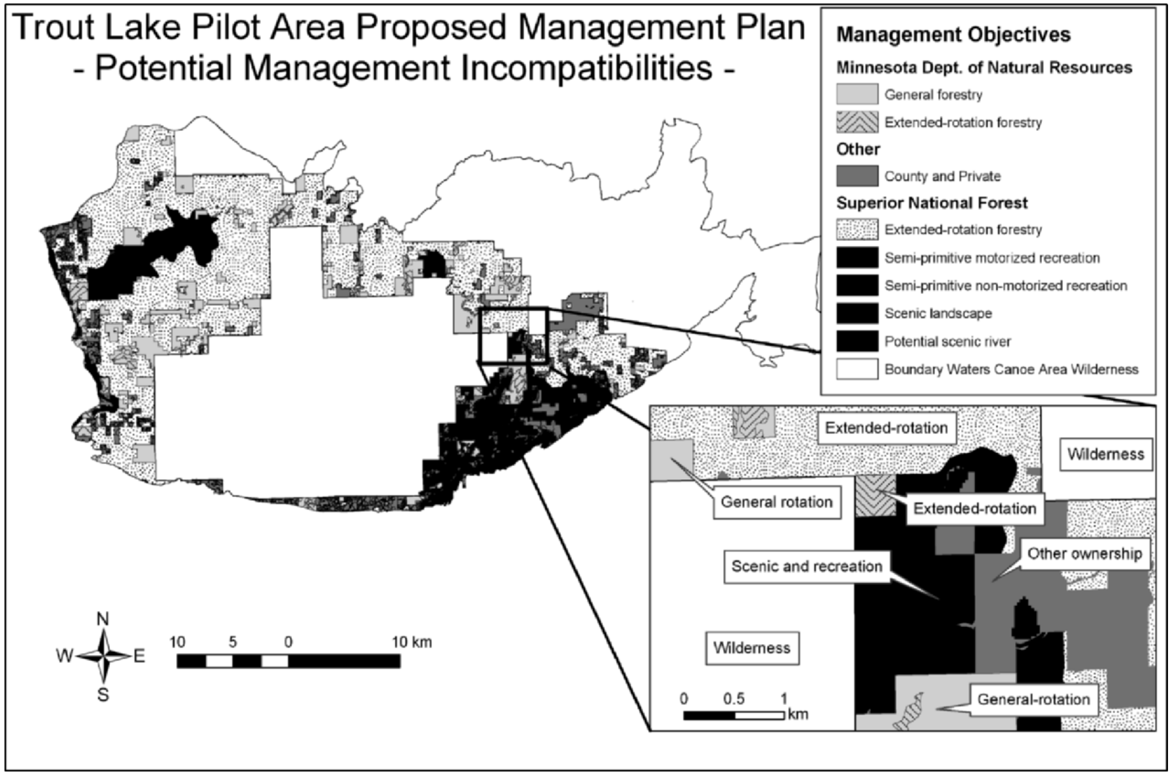

Figure 5.7. Potentially incompatible land management objectives under the proposed management scenario. The inset highlights part of the Trout Lake pilot area to show the juxtapositioning of land management objectives.

knowledge transfer and communication emerged: natural resource managers and decisionmakers. Flexibility in the size and timing of update meetings was essential in order to obtain feedback from resource managers. Agency partners, including the Superior National Forest, the Minnesota Department of Natural Resources, and Voyageurs National Park, critiqued the pilot model results during two separate sessions. Representatives from the Department of Natural Resources and Quetico Provincial Park were unable to attend either session, necessitating individual updates for their staff. Results from the pilot project were well received, with several insights gained into the ways in which the approach could be helpful to each agency's mission, planning efforts, and land management. We considered this to be successful knowledge transfer, and a breakthrough in the project. The pilot project enabled us to establish internal advocates and identify early implementers among the technical partners.

Although well-received by the Voyageurs National Park staff, the pilot project was less directly relevant to their routine management and planning because no National Park lands were located within the pilot area. Moreover, the park's recent staff changes required the team to update them on the Border Lakes project's background and history. We expect that expansion of the model to cover the entire landscape will create opportunities for greater participation on the part of park staff in the future.

5.6.4. Phase Four: Build Institutional Support

Building on the renewed enthusiasm among the resource managers permitted additional outreach to institutional decisionmakers for continued, landscape-level modeling. We developed a fact sheet to explain the pilot modeling results and the potential for the information to inform existing management plans and future collaborative activities (TNC 2004). With the cooperation of a key Superior National Forest technical team member, outreach began with National Forest decisionmakers and the Minnesota Forest Resources Council. This Council, the primary large-scale goal-setting body for forests in Minnesota, encompasses government agencies, nongovernmental organizations, and timber-industry partners. The Council invited core team members to present their preliminary results to a broader audience, leading to a grant awarded to the team, matched by the National Forest, to continue the ecological modeling work. Again, we considered this to be a successful knowledge transfer, made easier by the existing technical backgrounds of National Forest and Council leadership.

Building institutional support was more difficult than expected within The Nature Conservancy as a result of communication and priority-setting challenges. Although the 3-year strategic plan of the Minnesota chapter of The Nature Conservancy identified the Border Lakes landscape as a priority, initial participation on the part of local program staff was limited, largely due to a lack of staff. Communication among key staff members also needed improvement, and the definition of roles and expectations needed to be clarified. Issues surrounding communication were

resolved in part by creating a vision document for The Nature Conservancy's role in fire issues related to northern forests. To advance the project, it was also necessary to distinguish clearly between two main project objectives: developing ecological models to create a scientific underpinning for modeling and identifying appropriate strategies for implementation. A long-term goal of greater partner involvement and leadership in building institutional support within participating agencies was also developed.

5.7. NEXT STEPS: INCREASING THE SCALE AND IMPACT OF THE PARTNERSHIP

Despite the challenges encountered during the first 2 years of the Border Lakes Partnership, scenario modeling for the Border Lakes landscape shows great promise for developing a collaborative vision. Based on the response from the project partners, we plan to take several additional steps. First, we will assemble the necessary data layers for the model and scale up the pilot modeling project to cover the entire landscape. We will continue to reach out to implementers and leaders in the short term, as appropriate, including leaders within both The Nature Conservancy and the North Central Research Station. We will develop a long-term plan for building institutional support more proactively to ensure that recommendations are considered in the development of cross-boundary strategies. At the fourth forum, we plan to emphasize broad strategies, with the full complement of appropriate Nature Conservancy staff participating in the exercise.

Despite a number of early accomplishments, the success of the knowledge transfer for the project as a whole will be judged by whether an understanding of landscape ecology principles and tools ultimately influences implementation, including on-the-ground management. The desire to achieve shared management goals for the partner agencies, including the reduction of hazardous fuels, timber production, and biodiversity conservation, is at the heart of this project. Knowledge transfer of landscape ecology principles and tools during this project has been introduced as part of the toolkit that land managers and agency leaders should consider to provide a landscape context for individual ownerships. The criteria by which the initiative's long-term outcomes will eventually be evaluated lie in the answers to the following questions:

- Have the individual agencies used the products to update their own plans?
- Have the products led to more examples of strategic versus tactical collaboration among the partners?
- Are individual agencies implementing portions of the process, principles, or approach in other internal or multipartner efforts in which they are involved?
- Have individual agencies assumed ownership of the products and tools produced during this project, to the point that the origins of these aids and the initial core team have been largely forgotten?

- Has public perception changed such that there is local community support for using prescribed fire as a management tool?

Answers to these questions will likely remain unknown in the near future, but it may be possible to address them within a decade.

5.8. LESSONS LEARNED

We learned a number of key lessons during the first 2 years of the project both from our early successes and from the continuing challenges. First and foremost, we learned that building relationships was an important precursor to knowledge transfer and that relationships among agency partners were strengthened by the knowledge transfer process. Better described as a collaborative learning process, knowledge transfer in our case consisted of a regular exchange of information and ideas among landscape ecologists, resource managers, and decisionmakers. Although landscape ecologists held the keys to the modeling technology that were central to the process, land managers and decisionmakers provided crucial insights and reality checks without which even the best of technologies would have no real-world significance. Among the greatest successes was the use of spatially explicit models to build a common foundation among the partners, a step that can lead to a common vision for the landscape. Among the continuing challenges that have surfaced thus far, the most pressing are time constraints and communication among the agency partners. As a result, the process has been driven by a core team of collaborators external to the management agencies. Although key agency technical staff have been successfully engaged, the work of communicating with agency decisionmakers is only about to begin, and there is no formula yet for how to do this successfully. A short summary of the lessons learned is presented in Table 5.4 as a list of "dos and don'ts."

5.8.1. Summary of Knowledge Transfer Challenges

We learned from a number of early oversights, and were able to change course through honest feedback from team members. The overuse of landscape ecology jargon topped our list of primary things to avoid during the knowledge transfer process. It was important for the landscape scientists involved to maintain an open attitude and a willingness to learn from land managers and decisionmakers throughout the process. A successful process also required that we abandon our linear approach to landscape-level planning and adopt a more adaptive approach. Adapting our process meant respecting the need of some partners to leap ahead to strategy development at various times, allowing iterative cycles between these strategies and the desired future condition.

Initially, we failed to recognize the importance of an effective communications plan to direct communication among and within agencies so as to facilitate the development of support for the project. Likewise, internal challenges (such as those within

Table 5.4. Summary of lessons from knowledge transfer in a multipartner landscape

Do	Don't
• Provide a regular forum for knowledge transfer, such as the Fire Learning Network.	• Insist that all partners attend all knowledge transfer events.
• Ensure that the knowledge transfer forums are well organized and make good use of partner time.	• Use obscure landscape ecology jargon.
• Provide multiple opportunities for partner input, such as individual meetings, review of documents, telephone interviews, and small technical working groups.	• Take a formulaic, linear approach to landscape-level planning.
• Ensure that a core group of team leaders keeps the project moving forward.	• Allow an individual naysayer to derail the process.
• Maintain as much continuity as possible in relationships among the core team and partners.	• Overlook internal challenges to project progress, even among the core team organizations.
• Identify an internal champion within each partnering agency.	• Allow landscape ecology tools to become a "black box."
• Encourage core team members to develop support from additional key colleagues within their respective organizations.	• Forget to maintain existing relationships while building new ones.
• Use science as the foundation, and then slowly build partner relationships through knowledge transfer.	• Fail to engage key umbrella organizations early in the process (e.g., the Minnesota Incident Command System, Minnesota Forest Resources Council).

The Nature Conservancy) were initially overlooked. Although a core team was essential to this process, we initially underestimated the importance of identifying agency staff to assume leadership roles in the project and to nurture existing relationships while building new ones. Initially, we also failed to adequately engage key umbrella organizations such as the Minnesota Incident Command System and Minnesota Forest Resources Council early in the process. Their involvement has subsequently been highly important given their broad constituency and influence.

5.8.2. Summary of Knowledge Transfer Successes

We did several things well in the realm of knowledge transfer. Providing a regular knowledge transfer forum, such as the Fire Learning Network, was beneficial both for peer review and for exchange of ideas, and it helped partners to dedicate blocks of time to work exclusively on a given project. Such a forum provides structure and much-needed milestones for the project. However, for a group with such diverse, geographically scattered partners as those in the Border Lakes Partnership, it was necessary to accommodate many partners by providing separate work sessions. A combination of peer review for core leaders and smaller work sessions with key partners represented the best combination for the Border Lakes Partnership. It was

crucial that the first forum was well-organized and had good content, and was the best attended of the three forums that have been held to date, because that success set the tone for future meetings.

Because we chose to use the LANDIS software, and thus needed an expert modeler to do the modeling work, it was even more critical to include all landowners in developing the modeling scenarios from the earliest stages to ensure successful knowledge transfer. The use of conceptual ecological models early in the collaborative learning process helped ensure that participants understood the natural dynamics and processes that we modeled using LANDIS. Establishing common ground at the beginning of the process assisted partners in focusing their contributions to the modeling work on key questions about forest succession, natural disturbance processes, and management activities that shape both disturbance and succession.

The importance of obtaining the assistance of an internal champion within each organization cannot be underestimated, although the degree of enthusiasm varied among these champions. Persisting in identifying a natural champion was critical, as these champions ensured that barriers continued to dissolve despite ongoing time and workload pressures. Maintaining as much continuity as possible, both among core team members and in the actual project work, and minimizing time lags were both important to the success of the project. To the extent possible, we tried to involve agency staff who expected to remain involved for the long term. In choosing a knowledge transfer approach, we learned that it is important to weigh the options of directly transferring modeling skills versus having key partners who already possess these skills guide the process.

Above all, we learned that although a science focus provides a strong foundation for such projects, knowledge transfer and collaborative learning are indispensable in building institutional support for new ideas. A successful project requires patience and a willingness to build on small successes. Knowledge transfer thus provides a bridge between the vision and the implementation that is the ultimate goal of any planning exercise.

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